

**Course Title: Cloud Computing**

**Credit: 3**

**Course No: CSIT.424.4**

**Number of period per week: 3+3**

**Nature of the Course: Theory + Lab**

**Total hours: 45+45**

**Year: Fourth, Semester: Eighth**

**Level: B. Sc. CSIT**

### **1. Course Introduction**

The course introduces the ideas and techniques underlying the principles of cloud computing. This course covers a series of current cloud computing technologies, including technologies for Infrastructure as a Service, Platform as a Service, and Software as a Service. This course is designed to introduce the concepts of Cloud Computing as a new computing paradigm. The students will have an opportunity to explore the Cloud Computing various terminology, principles and applications. The course will expose students to different views of understanding the Cloud Computing such as theoretical, technical and commercial aspects.

### **2. Objectives**

The primary learning outcomes are that the students will be able to: Explain the core concepts of the cloud computing paradigm: how and why this paradigm shift came about, the characteristics, advantages and challenges brought about by the various models and services in cloud computing, Discuss system virtualization and outline its role in enabling the cloud computing system model, Analyze various cloud programming models and apply them to solve problems on the cloud.

The main objective of this course is:

- To provide students with the fundamentals and essentials of Cloud Computing.
- To provide students a sound foundation of the Cloud computing so that they are able to start using and adopting Cloud Computing services and tools in their real life scenarios.
- To provide the knowledge about the SOA, cloud security and cloud disaster management

### **3. Specific Objectives and Contents**

<b>Specific Objectives</b>	<b>Contents</b>
<ul style="list-style-type: none"><li>• Understand basics cloud framework</li><li>• Understand concepts of cloud computing</li><li>• Understand the features of cloud computing</li><li>• Understand the cloud</li></ul>	<p><b>Unit I: Introduction (9 Hrs)</b></p> <ul style="list-style-type: none"><li>1.1. Cloud, Cloud computing, Components of cloud computing, Characteristic features of cloud computing,</li><li>1.2. Evolution of cloud computing, Challenges for the cloud computing, Benefits of cloud computing,</li><li>1.3. Grid computing, Cloud Computing vs Grid Computing, Distributed Computing in Grid and Cloud,</li><li>1.4. Cloud deployment models: Public, Private, Hybrid, Community,</li></ul>

deployment models	1.5. Cloud Service Models: IaaS, PaaS, SaaS, 1.6. Challenges for cloud computing, Legal issues in cloud computing.
<ul style="list-style-type: none"> <li>• Understand concepts of virtualization and its approaches</li> <li>• Explore concepts of virtualization in cloud environment</li> </ul>	<b>Unit II: Virtualization (5 Hrs)</b> 2.1. Basic Concepts of virtualization, Hardware virtualization, Server virtualization, Storage virtualization, Data Centre virtualization OS virtualization, Para virtualization, 2.2. Role of virtualization in enabling cloud services, Cloud computing as a virtualized service.
<ul style="list-style-type: none"> <li>• Understand the cloud migration and its need</li> <li>• Explore the cloud migration model</li> <li>• Determine the risks during cloud migration</li> </ul>	<b>Unit III: Cloud Migration(4 Hrs)</b> 3.1. Cloud Migration and its types, Need for Cloud Migration, 3.2. Model of Migration into a cloud, 3.3. Migration risks in Cloud and Mitigation.
<ul style="list-style-type: none"> <li>• Understand various cloud service models</li> <li>• Understand and analyze various aspects of the cloud service models</li> <li>• Explore the real world cloud services</li> </ul>	<b>Unit IV: Cloud Service Models (15 Hrs)</b> 4.1. Infrastructure-as-a-Service (IaaS), 4.2. Platform-as-a-Service (PaaS), Key Characteristics of PaaS, 4.3. Software-as-a-Service (SaaS): SaaS Implementation Issues, Key Characteristics of SaaS, Benefits of the SaaS Model, 4.4. Communication-as-a-Service (CaaS): Advantages of CaaS, 4.5. Monitoring-as-a-Service (MaaS), 4.6. Jericho Cloud Cube Model, 4.7. Amazon's Web Services, 4.8. Cloud Computing from the Google Perspective, 4.9. Window Azure and Online Services.
<ul style="list-style-type: none"> <li>• Understand Service Oriented Architecture (SOA)</li> <li>• Explore significance of SOA in Cloud Computing</li> </ul>	<b>Unit V: SOA and Cloud (4 Hrs)</b> 5.1. Service Oriented Architectures (SOA), 5.2. Combining the cloud and SOA 5.3. Characterizing SOA, 5.4. Importance of SOA to cloud computing
<ul style="list-style-type: none"> <li>• Understand security in cloud</li> <li>• Understand risk assessment in cloud</li> <li>• Explore various intrusion detection mechanisms in cloud environment.</li> <li>• Understand how to handle cloud disasters and how to mitigate the disaster</li> </ul>	<b>Unit VI: Cloud Security (8 Hrs)</b> 6.1. Cloud Security Challenges, Dimensions of Cloud Security: Security & Privacy, Compliance, and Legal or Contractual Issues, 6.2. Risk Management, Security Monitoring, Incident Response Planning, Security Architecture Design, Vulnerability Assessment, Data and Application Security, Virtual Machine Security, 6.3. Handling Disasters in Cloud, Disaster Recovery, Disaster Recovery Planning, Disaster Management.

## Evaluation System

Undergraduate Programs							
External Evaluation	Marks	Internal Evaluation	Weight age	Marks	Practical	Weight age	Mark
End semester examination	60	Assignments	20%	20	Practical Report copy	25%	20
(Details are given in the separate table at the end)		Quizzes	10%		Viva	25%	
		Attendance	20%		Practical Exam	50%	
		Internal Exams	50%				
Total External	60	Total Internal	100%	20		100%	20
Full Marks 60+20+20 = 100							

### External evaluation

#### 1. End semester examination:

It is a written examination at the end of the semester. The questions will be asked covering all the units of the course. The question model, full marks, time and others will be as per the following grid.

#### 2. External Practical Evaluation:

After completing the end semester theoretical examination, practical examination will be held. External examiner will conduct the practical examination according to the above mentioned evaluation. There will be an internal examiner to assist the external examiner. Three hours time will be given for the practical examination. In this examination Students must demonstrate the knowledge of the subject matter.

Full Marks: 100, Pass Marks: 45, Time: 3 Hrs

Nature of question	Total questions to be asked	Total questions to be answered	Total marks	Weightage
Group A: multiple choice*	20	20	20×1 = 20	60%
Group B: Short answer type questions	7	6	6×8 = 48	60%
Group C: Long answer type questions	3	2	2×16 =32	60%
			100	100%

Each student must secure at least 50% marks in internal evaluation in order to appear in the end semester examination. Failed student will not be eligible to appear in the end semester examinations.

### Internal evaluation

**Assignment:** Each student must submit the assignment individually. The stipulated time for submission of the assignment will be seriously taken.

**Quizzes:** Unannounced and announced quizzes/tests will be taken by the respective subject teachers. Such quizzes/tests will be conducted twice per semester. The students will be evaluated accordingly.

**Attendance in class:** Students should regularly attend and participate in class discussion. Eighty percent class attendance is mandatory for the students to enable them to appear in the end semester examination. Below 80% attendance in the class will signify NOT QUALIFIED (NQ) to attend the end semester examination.

**Presentation:** Students will be divided into groups and each group will be provided with a topic for presentation. It will be evaluated individually as well as group-wise. Individual students have to make presentations on the given topics.

**Mid-term examination:** It is a written examination and the questions will be asked covering all the topics in the session of the course.

**Discussion and participation:** Students will be evaluated on the basis of their active participation in the classroom discussions.

**Instructional Techniques:** All topics are discussed with emphasis on real-world application. List of instructional techniques is as follows:

- Lecture and Discussion
- Group work and Individual work
- Assignments
- Presentation by Students
- Quizzes
- Guest Lecture

Students are advised to attend all the classes and complete all the assignments within the specified time period. If a student does not attend the class(es), it is his/her sole responsibility to cover the topic(s) taught during that period. If a student fails to attend a formal exam/quiz/test, there won't be any provision for re-exam. Unless and until the student clears one semester he/she will not be allowed to study in the following semesters.

### **Laboratory Work**

Student should have practical session for realization of cloud services as well as virtualization. The tools and frameworks for the simulation of cloud and virtualized environments can be decided by the instructor. The lab work should be practiced for minimum of 3 lab hours per week.

## Prescribed Text

1. Dan C. Marinescu, *Cloud Computing: Theory and Practice*, Morgan Kaufmann.

## References

1. Rajkumar Buyya, The University of Melbourne and Manjrasoft Pty Ltd., Australia, James Broberg, The University of Melbourne, Australia Andrzej Goscinski, Deakin University, Australia, *Cloud Computing Principles and Paradigm*, John Wiley and Sons Inc. Publication.
2. John W. Rittinghouse and James F. Ransome, *Cloud Computing: Implementation Management and Security*,
3. George Reese, *Cloud Application architecture*, O'Reilly Media Inc.
4. Judith Hurwitz, Robin Bloor, Marcia Kaufman, Fern Halper, *Cloud Computing for Dummies*, Wiley Publishing Inc.
5. Borko Furht, Armando Escalante, *Handbook of cloud computing*, Springer, 2010
6. David S. Linthicum, *Cloud Computing and SOA Convergence in your Enterprise*, a step by step guide, Addison Wesley